

# Consumer Investments in Energy Efficiency: Knowledge Gaps, Research Frontiers, and Policy Implications

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# The questions addressed

- ❑ “Why haven’t customers adopted cost-effective efficiency measures more fully without incentives or mandates?”
  - ❑ “What additional information...would result in more customers adopting sustained energy-efficiency practices or investing in efficient technologies?”
  - ❑ “What is required to transition from incentive-based to self-motivated adoption of energy efficiency by consumers?”
- ❑ *The purpose of this talk is to summarize why the research community still cannot answer these questions - 25+ years after they were first raised - and to sketch what kinds of research are needed to do so.*

# The “Energy-Efficiency ‘Gap’ ”

- ❑ This terminology is used to describe the phenomenon of non-adoption of apparently cost-effective efficiency technologies or measures
- ❑ The problem was first raised in the late 1970s, following early programmatic experience and research findings
- ❑ It has been the subject of periodically intense debate since, but little constructive engagement, and no resolution
- ❑ Two primary ‘camps’ exist...

# The “Technology” perspective

- ❑ Potential and other studies demonstrate that significant cost-effective efficiency opportunities exist across sectors
- ❑ Customers’ failure to adopt is a consequence of various “market barriers:”
  - ❑ Risk / uncertainty, attitudes, misplaced incentives, transaction costs, a *lack of information*, etc..
- ❑ These barriers justify policies - utility programs, codes and standards - to promote the diffusion of efficient technology

# The “Economics” perspective

- ❑ There appear to be cases in which cost-effective investments are not made, but there is a “\$20 bill on the sidewalk” problem:
  - ❑ “[There is] an important threshold question of why cost-minimizing firms would ever need any help from government programs to take actions that would lower their costs.”
  - ❑ “If these technologies are such big winners, then why aren’t people and firms already adopting them?”
- ❑ There may be *market failures* underlying the “efficiency gap” - these would be the only justification for policy
  - ❑ Potential market failures are a much shorter list than “market barriers,” most of which do not warrant policy
- ❑ The most likely market failures at work here have to do with *information* problems

# Problems with conventional wisdom

## ❑ On the technology side:

- ❑ Some of the commonly-cited “market barriers” are plausible, but others are not, and in any case there has been little systematic, quantitative research to determine which is which and their relative importance

## ❑ On the economics side:

- ❑ Among other problems: Are these efficiency opportunities really “\$20 bills?”

## ❑ The “information” hypothesis would appear to be a promising point of common ground

## ❑ The problem is that, taken at face value, it is false:

- ❑ It has been known since the 1970s that providing ‘information,’ per se, is in general insufficient to compel customers to invest in energy efficiency

# A methodological source of this impasse

- ❑ Technology and economic studies of the “gap” tend to use different technical approaches, but both focus almost exclusively on “implicit discount rates” for efficiency investments - the rates-of-return that customers *appear* to require for adoption
- ❑ The “gap” is equivalent to the consistent finding of rates that are much higher than market interest rates for borrowing or saving
  - ❑ This is essentially equivalent to the observation that customers require very short payback times
- ❑ The problem is that high implicit discount rates as determined by standard methods only reveal the symptom, not the underlying causes, of customers’ reluctance to invest

# Research directions I

## □ Recognizing consumer heterogeneity:

- Preferences, income, energy service needs, and other factors vary widely
- These differences matter for understanding investment decisions, but are not accounted for in ‘average’ calculations
- An analogy: Variation in elasticities in time-of-use pricing environments

## □ Taking account of the multi-dimensionality of the efficiency choice problem:

- A simple trade-off between purchase price and operating cost is almost never a good description of the efficiency investment problem
- The example of florescent lighting
- “Hidden costs” for some technologies, and “hidden benefits” for others, do *not* cancel one another out



# Research directions II

- ❑ The over-arching need is to complement the traditional focus on technology with a *behavioral* framing of the efficiency choice problem
- ❑ Moving beyond implicit discount rates to understand customers' actual decision rules for evaluating investment opportunities:
  - ❑ Life-cycle cost minimization, utility or profit maximization, etc., are very poor models of how customers themselves frame the problem and undertake decisions, e.g., they may not be 'discounting' at all
- ❑ New frontiers in economics are highly applicable:
  - ❑ "Behavioral" and "experimental" economics are rapidly developing alternatives to the classical models of "homo economicus"
- ❑ These new approaches need to be combined with an older tradition of social science research on energy

# Policy relevance: Why these issues are not 'academic'

- ❑ Addressing the questions posed is important for energy policy, but...
- ❑ It is *vital* for climate change/ greenhouse gas policy - the Governor's goals illustrate why:
  - ❑ Meeting the near-term goals will be a challenge, but we know a broad range of measures - energy efficiency and others - that can be deployed
  - ❑ We do *not* currently know how to meet targets such as the 80% reduction below 1990 levels by mid-century at acceptable cost
- ❑ These long-run targets imply a different kind of energy system, and energy-economy, than we have today

# Policy relevance, cont.

- ❑ Our current policy environment - particularly codes and standards - sets a *floor* under efficiency levels in the markets
- ❑ But achieving a low-or-no carbon society will require moving customers toward the “*ceiling*:”
  - ❑ In effect, “technical potential” must become the norm among households and firms
- ❑ Understanding how to do this will require seeing energy through the customers’ eyes:
  - ❑ We need to create “smart and efficient customers” along with efficient technologies

# Final remarks: The relationship to demand response

- ❑ A parallel - and closely linked - set of issues arise in attempting to stimulate demand response:
  - ❑ The home or office energy environment is extremely complex, and becomes more so with the introduction of dynamic pricing
- ❑ How customers 'navigate' their energy environment - including their responses to changes in the price regime - is also not-at-all well-understood
- ❑ Energy-focused information technology may revolutionize the joint investment/ utilization/ price-response problem, and is highly likely to be a key to the low-carbon future

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